

US Army Training and Doctrine Command Analysis Center - Monterey *Overview and Thesis Topics*



Briefing for: OR Students

16 May 2007

Introduction

- **Purpose: Provide Overview of TRAC-Monterey and potential thesis topics.**
- **Agenda**
 - **TRADOC and TRADOC Analysis Center background.**
 - **TRAC-Monterey mission and organization.**
 - **Sample of current TRAC-Monterey efforts.**

TRAC Mission



**Provide relevant, credible
operational analysis to inform
decisions.**

Support TRADOC Mission

• Recruit, Train & Educate the Army's soldiers.

- Develop Leaders.
- Support Training in Units.
- Develop Doctrine.
- Establish Standards.
- Build The Future

Army.

Capabilities Development

- Develop & synchronize Joint and Army concepts.
- Identify capability gaps.
- Integrate DOTMLPF solutions.
- Validate S&T priorities.
- Synchronize Army capabilities with JIM capabilities.

TRAC Mission Essential Task List (METL)

- Conduct the studies that inform key decisions made by TRADOC, Army, and Joint leaders.
- Lead the analysis for major Army experiments.
- Develop and maintain scenarios to underpin Army concepts & requirements.
- Develop, configuration manage and apply verified and validated M&S.

Develop & Apply Models and Simulations

First To Model

Develop, maintain, configuration manage, and apply tactical and operational-level simulations for Army and Joint use.

Advanced Concepts and Requirements

- Force-on-force operations.
- Co/Team through Corps.
- Joint & combined arms.
- OE asymmetric and irregular threats; complex environs.
- Gap assessment, knowledge acquisition, and research to develop methods and models.

Current TRAC Models

- Corps/DIV: VIC
- BDE/BN: CASTFOREM, Janus

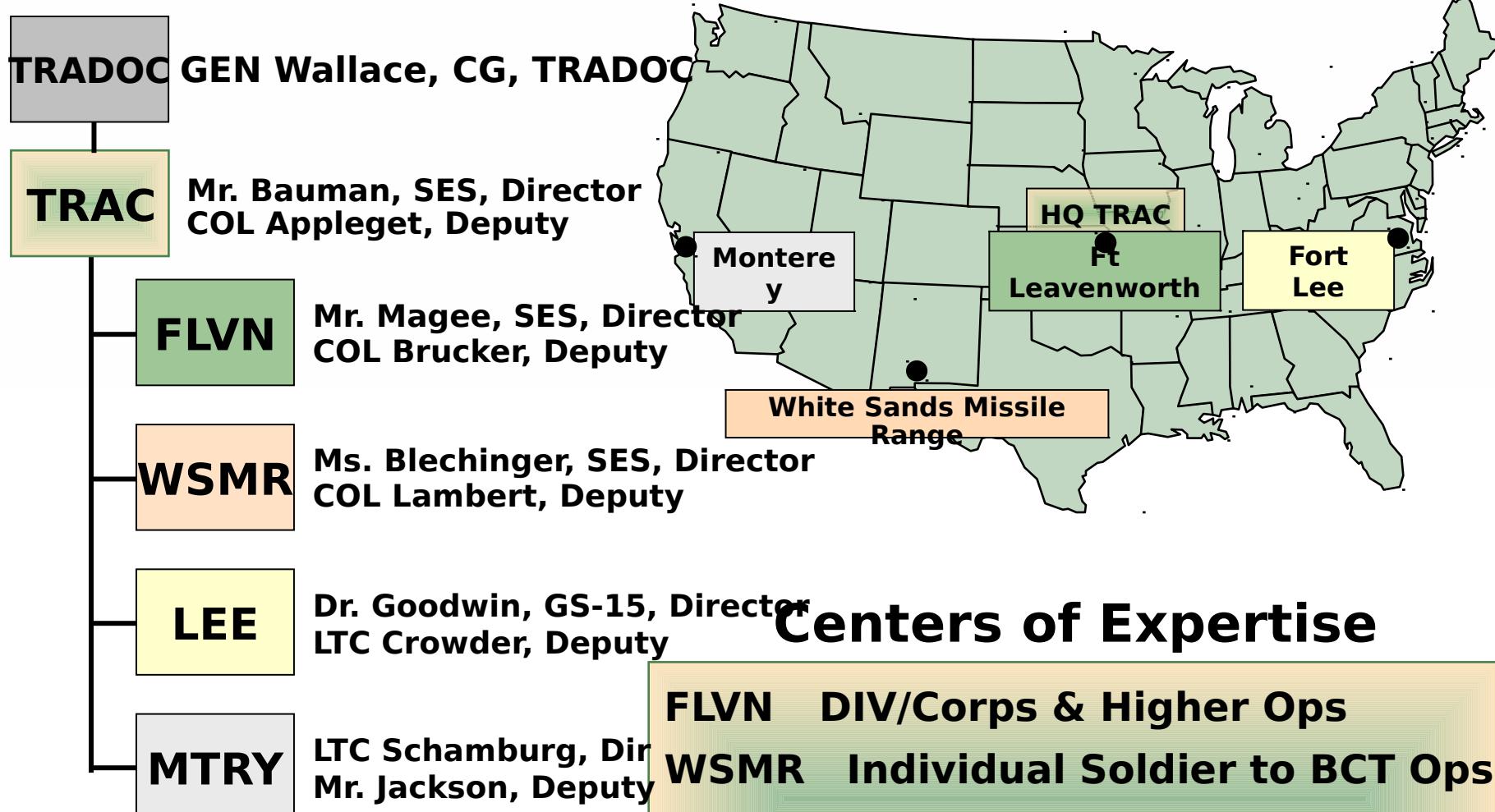
Modeling Initiatives

- MOUT, C4ISR, Logistics, Joint and OE.
- AWARS, Combat XXI

Research & rapid tool enhancement to depict future operations.

Payoff to larger simulation community.

TRAC Organization



Centers of Expertise

FLVN	DIV/Corps & Higher Ops
WSMR	Individual Soldier to BCT Ops
LEE	Sustainment
MTRY	Research

TRAC-Monterey Mission and Vision

Mission

Perform relevant and credible exploratory and applied research to support the TRAC mission.

Vision

TRAC-Monterey is recognized as a premier applied research organization for military modeling, simulation, methodologies, and analysis.

Our work will be relevant, credible, and user focused.

TRAC-Monterey Organization

Director

ERDC Liaison

Mr. Pranger

LTC Schamburg

Deputy

Mr. Jackson

Operations Research Analysts

LTC Ahner

MAJ Alt

MAJ Spainhour

MAJ Tollefson

MAJ Ugarte

M&S - MAJ Martin

Temp Assigned- CPT Smith

TRAC Rotating Analyst (Open)

Supporting Analysts

Mr. Ruck

Mr. Yamauchi

Ms. Wu

Administrative Support

Secretary / Admin
Ms. Lackey

Computer / Lab Support
Mr. Liberato

IT & Network Support
NPS

Comptroller / Contracting
NPS

Personnel / Admin Services
POM

Personnel Background

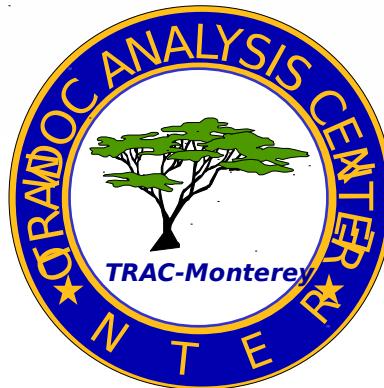
LTC Jeff Schamburg, IN	PhD SE - University of Virginia
Mr. Jack Jackson, FA(R)	MS OR - Naval Postgraduate School
LTC Darryl Ahner, SC	PhD SE - Boston University
MAJ Eric Tollefson, IN	MS OR - Georgia Tech
MAJ Jon Alt, IN	MS OR - Naval Postgraduate School
MAJ Rich Spainhour, AR	MS OR - Colorado School of Mines
MAJ Manuel Ugarte, CHEM	MBA - Tarleton State University
MAJ Mike Martin, AR	MS M&S - Naval Postgraduate School
CPT Bill Smith, ORD	BS Math - Cameron University
Mr. Steve Pranger, ENG	BS Math & BS Chem Eng - U of CT
Mr. Harold Yamauchi	MS OR - Oregon State University
Ms. Jane Wu	MS Statistics - University of Texas at Austin
Mr. John Ruck, Navy(R)	MS OR - Naval Postgraduate School,

**Highly Professional Team That Maintains Our Core Values:
Integrity, objectivity, courage, innovation, courtesy, respect, caring,
growth, team work, communication, and high standards.**

TRAC-Monterey Partnerships

Military

- Other TRAC Centers
- Engineer Research and Development Center (ERDC)
- DARPA
- STRATCOM
- Army Infantry Center
- PEO Soldier
- PM Future Force Warrior
- Natick Soldier Center
- Army Materiel Systems Analysis Activity (AMSAA)
- Army Research Office (ARO)
- Army Research Lab (ARL)
- Air Force Research Lab (AFRL)
- Army Rapid Equipping Force (REF)
- Defense Modeling & Simulation Office
- Joint Ground Robotics Enterprise Office
- Joint Urban Operations Office
- Joint IED Defeat Organization
- Marine Corps Combat Development Command (MCCDC)
- Army G3/5/7
 - Battle Command Simulation and Experimentation (BCSE) Directorate
 - Army Modeling & Simulation Office
- PEO STRI
- PM OneSAF



Academia

NPS:

- Applied Mathematics
- Business & Public Policy
- Computer Science
- Defense Analysis
- Engineering Management
- Homeland Defense & Security
- Information Sciences
- Mechanical Engineering
- MOVES
- Systems Engineering
- Operations Analysis
- HSI Lab and SEED Lab

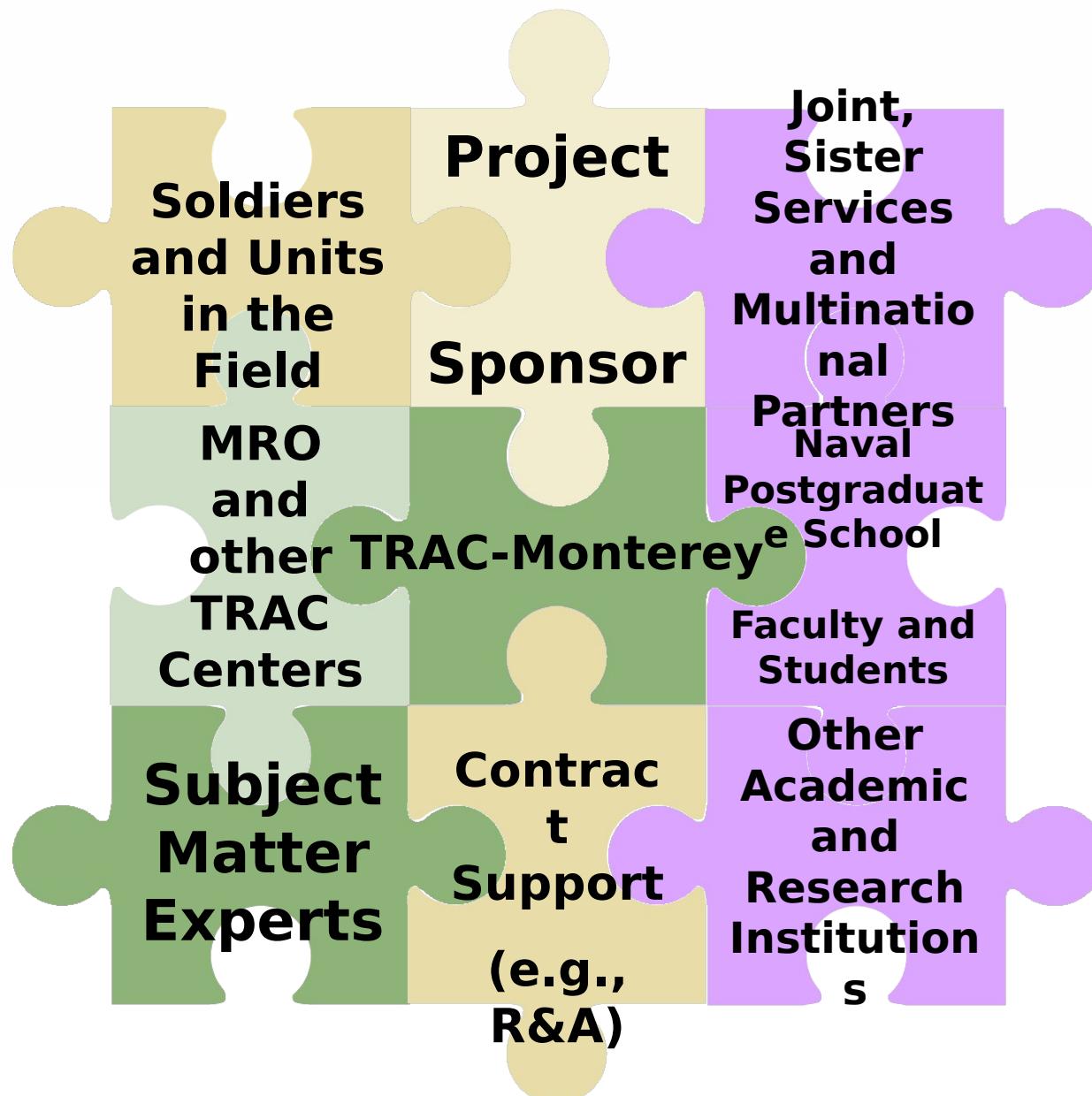
USMA

- Systems Engineering
- Mathematical Sciences
- Operations Research Center

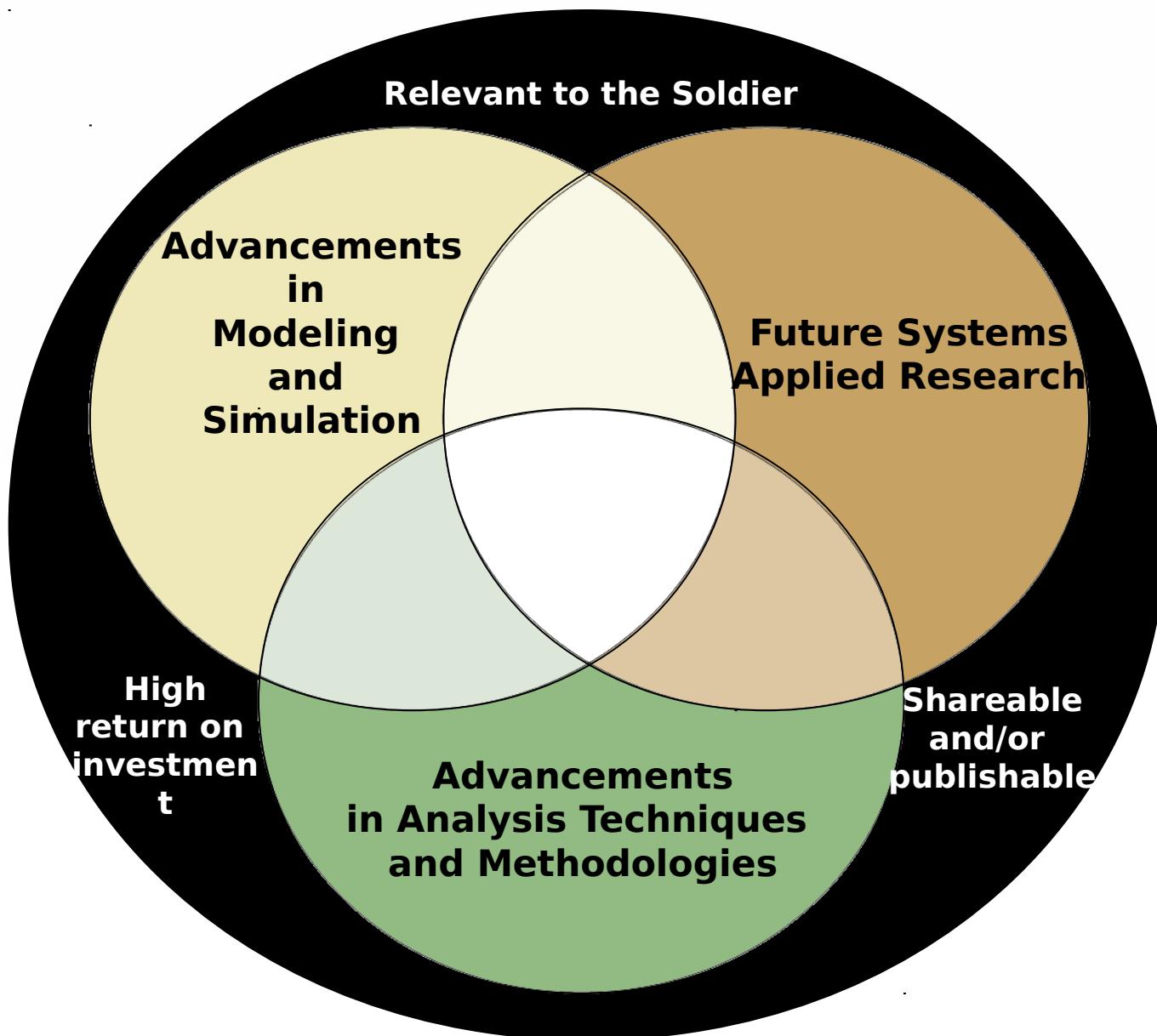
Contractors

- Rolands and Associates Corp.
- Applied Research Associates (ARA)
- Advanced Systems Technology (AST)
- ALATEC, Inc.

TRAC-Monterey Partnership Model

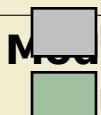


TRAC-Monterey Research



FY07 Research Projects

<u>Area 1: Advancements in Modeling and Simulation</u>	<u>Sponsor</u>	<u>Partners</u>
OOS Behavior Development and Verification	PM OOS	TRAC-WSMR
Dynamic Sustainment & Logistics Battle Command (LBC) & LBC for EAB Model Development	Army G3 & TRAC	TRAC-Centers, MRO, AMSAA, CASCOM
Urban Operations (UO) Focus Area Collaborative Team	Army G3 & TRAC	Numerous
Joint Dynamic Allocation of Fires and Sensors	Army G3 & TRAC	TRAC-FLVN, TRAC-WSMR, MRO, AMSAA
UAV Mix Tool for Force Modularity	TRAC	TRAC-Centers, MRO
Multi-Purpose Enterprise Simulation Suite (MPESS)	Army G3	Numerous
Soldier & Small Unit Representation; Modeling Close Range Quick Reaction Engagements	Army G3 & TRAC	TRAC-WSMR, MRO, AMSAA, Natick
Effects of Ambiguity on the MDMP	Army G3 & TRAC	TRAC-FLVN, MRO
Modeling Ambiguity of Sensors & False Positive Perceptions	Army G3 & TRAC	TRAC-FLVN, MRO



Recently Completed Project



Multi-year Project



Up-coming Project

Follow-on Effort Requested Sponsor

FY07 Research Projects

<u>Area 2: Advancements in Analysis Techniques and Methodologies</u>	<u>Sponsor</u>	<u>Partners</u>	
Soldier & Small Unit Modeling & Analysis; Close Quarter Skills & Activities	Army G3 & TRAC	TRAC-WSMR, AMSAA, Natick	
Soldier Modeling & Analysis Information Dissemination	TRAC	TRAC-WSMR, Natick	
High Performance Computing and Experimental Design	TRAC	SEED Lab, Natick, TRAC-Centers, MRO	
Rapid Equipping Force (REF) Analysis Methodology	REF	TRAC-MRO, ERDC	
Global Defense Posture ISR Analysis Methodology	STRATCOM	TRAC-FLVN, MRO, STRATOM	
Modeling Urban Cultural Geography in Stability Ops	DMSO	SEED Lab, TRAC-Centers, MRO, TRISA, MCCDC	
Army Reserves Capabilities Based Prioritization	OCAR	Numerous, TRAC-LEE	
Interior Building Performance of SUGVs	Army G3 & TRAC	TRAC-WSMR, TRAC-FLVN, MRO, ERDC	
 Recently Completed Project.  Follow-on Effort Requested by Sponsor.	 Multi-year Project.  Single-year Project.	 Up-coming Project.  Idaho National Lab (INL)	 TRAC-Centers, Joint Ground Robotics Enterprise Office, INL

FY07 Research Projects

<u>Area 3: Future Systems Applied Research</u>	<u>Sponsor</u>	<u>Partners</u>
Battle Command Experiments 6 & 7	DARPA/PEO STRI	Numerous
Homeland Security Simulation, Wargaming, & Analysis	DHS & NORTHCOM	TRAC-WSMR, ERDC
Future Force Warrior TTP & Distributed Capabilities Analyses and Exp Design	PM FFW	Natick, Infantry Center, PEO Soldier, TRAC-WSMR, MRO
Commander to Sensor Metrics	ARO & ARL	TRAC-FLVN, TRAC-WSMR, MRO
Land Warrior / Mounted Warrior DOTMLPF Assessment	PM Soldier Warrior	TRAC-WSMR, MRO, ATEC, AMSAA, DLI
Soldier & Small Combat Unit SA in CBR Environments	AFRL	TRAC-WSMR, MRO, Numerous
IED Prediction Capability Analysis <small>Recently Completed Project.</small> <small>Follow-on Effort Requested by Sponsor.</small>	IEDDO <small>Multi-year Project.</small> <small>Single-year Project.</small>	TRAC-WSMR, TRAC-FLVN, Numerous

Combat Modeling Lab

- **Models**
 - IWARS
 - COMBAT^{xxi}
 - OneSAF Objective System (OOS)
 - JDAFS
 - ASC-U
 - Janus
 - EPiCS
 - Dynamic Sustainment
 - Log Battle Command
- **Agent Based Models**
 - Pythagoras
 - MANA
- **Others**
 - As necessary
- **Research**
 - TRAC Analysts
 - Faculty Partners
 - Student Theses
- **Education**
 - Lab Tours
 - Open Houses
 - Class Projects

Some Specific Future Project Directions

- **UGV metrics and M&S projects; UAS model advancements; and Manned vs. Unmanned Systems projects.**
- **Experimental Design and High Performance Computing Cluster Efforts.**
- **Joint representation; Joint M&S (continue to pursue development of JDAFS); and Joint analysis techniques and methodologies.**
- **Human dimension research and representation; Operational Environment research and representation.**
- **Sustainment Battle Command M&S and analysis efforts.**
- **Research topics in support of current GWOT, OIF, & OEF issues (eg. IED data analysis).**
- **Work closely with the C4ISR, Soldier, & Log FACTs to advance M&S WRT identified CRAs.**
- **Lead UO FACT and address UO FACT CRAs.**
- **Maintain Focus on advancing OOS, Combat XXI, & IWARS**

Continue to Grow Relationship with other TRAC Centers and NPS.

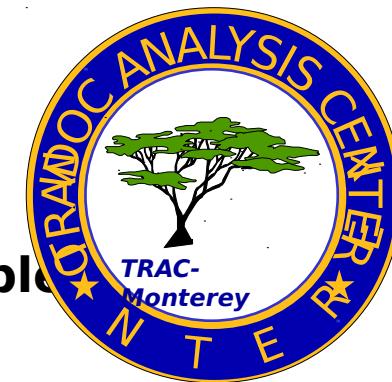
Future Directions

- Focused on the TRAC Strategic Plan.
- Continue our strong relationship with TRAC Centers, NPS, and other agencies.
- Receptive to external ideas that support our vision, mission, and research pillars.



Criteria

- Relevant to the soldier
- High return on investment
- Shareable and/or publishable



TRAC-Monterey

Current and Proposed Research



Current and Proposed Projects

Representing Urban Cultural Geography in Stability Operations

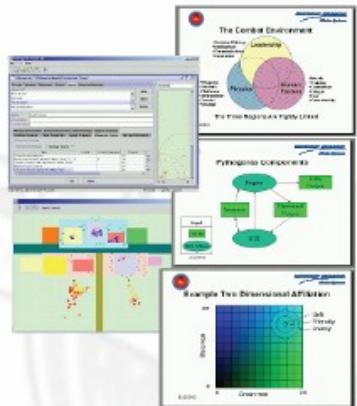
Project Description: Civilian human behavior representation (HBR) is the most significant gap in representing political, military, economic, social, information, and infrastructure (PMESII) aspects of the current operating environment (COE) in urban operations. Data collection, knowledge acquisition, and behavior representation methods for organizational and societal models are deficient. These models must address cultural influences and non-traditional warfare.

Technical Approach:

1. Gather subject matter expert (SME) input from the fields of human behavior, sociology and international relations.
2. Identify historical examples and gather relevant input.
3. Develop data sets and algorithms that account for cultural influence in non-traditional warfare.
4. Develop models and code to represent these behaviors for stability operations in current models.

Sponsor: TBD

Partners: NPS, TRAC-WSMR, MRO, MCCDC, CAA



Pythagoras (an agent based simulation) and IWARS screenshots showing models being used for analysis.

Potential Supporting Research Topics:

1. Documented methodology and algorithms to represent civilian populations and their behaviors in an urban environment during stability operations.
2. A modeling framework for cultures and societies in the context of non-traditional warfare as well as the behaviors of the entities making up these populations.
3. An implementation that could take the form of a stand-alone product focused on modeling cultural aspects of stability operations or an implementation integrated directly into current models.

Modeling Ambiguity through False Positive Perceptions

Project Description: Many simulations provide sophisticated perception algorithms which focus on whether or not entities can see each other. This approach often neglects, however, the possibility of entities mistakenly perceiving entities that do not exist. The project will gather experimental data to determine the frequency of these "False Positive" perceptions, develop models based on that data, and create prototype simulations for demonstration.

		Enemy Present	
		Yes	No
Enemy Acquired	Yes	Correct	False Positive
	No	False Negative	Correct

A false positive is considered to be when an entity makes an acquisition when no enemy is present. Many Simulations using observer-to-target perception algorithms, such as ACQUIRE, implicitly neglect all acquisitions on the right side of the chart.

Technical Approach:

Conduct thorough background research, focusing on the CASTFOREM and COMBAT XXI simulations to identify exist "false positive" methodology, develop and conduct appropriate experiments to capture additional data concerning False Positive acquisitions. Based on experimentation results, develop model and software to implement models.

Sponsor: C4ISR FACT

Partners: Natick, MRO, PM OOS, FLVN,

WSMR, MRO

General Research Topics:

1. HSI, HF, Survey, and/or Human Performance Experimentation on target detection.
2. Model creation and analysis based on perception data.
3. Simulation modeling and analysis based on perception model.

Ambiguity of Sensor Detection Data and Accuracy

Project Description: This project will produce a comprehensive, flexible descriptive model of combat assessment (CA) and a blue force information model of threat forces for current and future forces that accounts for inaccurate identification/classification/affiliation of acquired entities and accounts for imperfect association of this information. This model provides a framework for fusing enemy force information and a basis for simulation of the combat assessment process in future tactical and operational force on force combat models.



Technical Approach: Decompose combat assessment and information flows and errors, develop association models to feed Kalman filter that, in turn, feeds a more robust BDA model.

Sponsor: C4ISR FACT

Partners: NPS, TRAC-MRO, TRAC-FLVN, TRAC-WSMR

Potential Deliverables (Timeline TBD):

- Use background work from the commander to sensor metrics research to model information flow from sensors to commanders.
- Develop simulation models to represent the ambiguity related to the collection of sensor information.
- Implementation of new, more robust BDA simulation models.
- Conduct HSI, HF, and human experiments to determine the value of information to commanders.

Effects of Ambiguity on the Military Decision Making

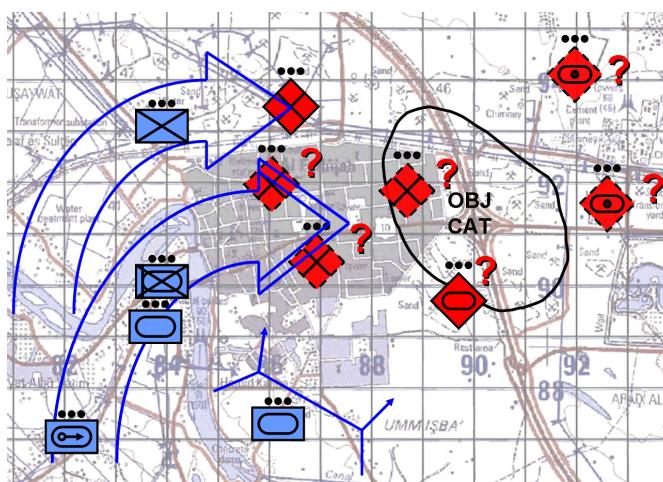
Project Description: Ambiguity has a recognized and critical affect on the battlefield and, therefore, battle command processes. What is lacking, however, is how this information and the ambiguity it creates impact the commander's ability in making decisions. This project will attempt to provide the foundational underpinnings that will inform the M&S community on the representable aspects of ambiguity and provide insights to its impact on the commander's military decision making.

Technical Approach:

- Identify & consolidate the many elements of ambiguity.
- Conduct a structured process using the HSI laboratory at NPS and military subjects to elicit data on the key contributors to ambiguity and their impacts on military decision-making.
- Discuss & analyze information gained in relation to its plausibility for use in M&S.

Sponsor: C4ISR FACT

Partners: TRAC-FLVN, NPS, PM OOS, MRO



How can Models and Simulations represent how battlefield ambiguity affects the ability of commanders to make decisions?

General Research Topics:

- Knowledge acquisition (KA) effort to elicit, analyze, and validate M&S specific information related to the definition, causes and effects of battlefield ambiguity.
- Identify the impacts of ambiguity on the military decision making.
- Identify the M&S applicability of the key impacts of ambiguity.

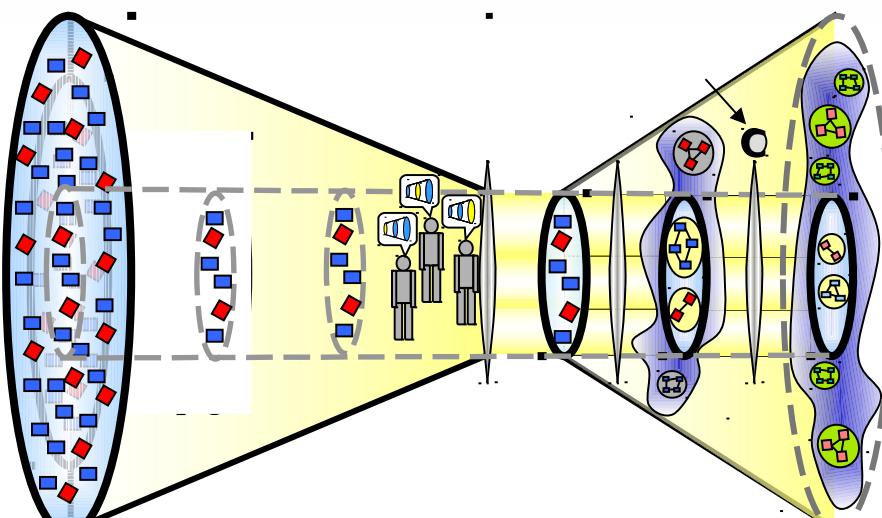
Developing Commander to Sensor Metrics

Project Description: Currently, sensors are placed on the battlespace according to predefined templates dictated by guesses of information needs. Data is sometimes fused into information but information seldom is fused into the required knowledge to answer the commander's operational questions. Sensor data is numerous and is pushed to systems throughout the battlespace.

Technical Approach: Develop metrics and human interfaces that allow information to be pulled or pushed to answer the commander's questions. Metrics should identify holes in the sensor data available so that new information requirements will result.

Sponsor: ARO.

Partners: NPS, TRAC-WSMR, ARL, NMST University



Dynamic Model of Situated Cognition

General Research Topics:

- Use background work from this research to model information flow to commanders.
- Conduct HSI, HF, and human experiments to determine the value of information to commanders.

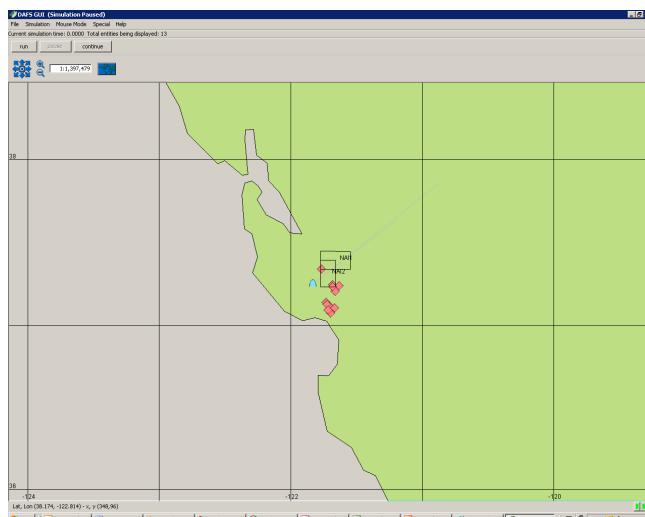
Joint Dynamic Allocation of Fires and Sensors (JDAFS)

Project Description: JDAFS is a quick-turn simulation that augments existing and emerging simulations to better enable studies and analyses. JDAFS lends insight into the application of networked fires and sensors for adoption in emerging simulations. The next phase of the project is development of a customer to drive development and use focusing on network allocation.

Technical Approach: Develop a low-resolution entity level simulation that uses a probabilistic rather than a physics-based approach for representing such processes as target acquisition by sensors. Explore network assignments.

Sponsor: Currently developing customer/sponsor.

Partners: NPS, R&A Corp., TRAC-FLVN/WSMR and MRO.



Graphic User interface depicting the dynamic assignment of sensors to named areas of interest.

Potential Supporting Research Topics:

- Develop scenario and conduct analysis to determine joint starting conditions for a Combat XXI analysis.
- Develop case study scenario to conduct exploratory analysis using JDAFS.
- Conduct JDAFS BDA and/or ambiguity modeling and analysis.

UAV Mix Tool Development and Analysis

Background: Need a tool that supports UAV airframe and payload mixes, UAV investment strategies, UAV organizations, and employment options for decisions as part of force transformation analysis. Unmanned/manned interactions and collaborative behavior needs to be modeled.

Purpose: Produce a tool that supports UAV Mix Studies.



Current and future capabilities impact the types and locations of UAVs needed to satisfy the payload requirements throughout the battlefield.

- **Description:** Develop a tool to analyze candidate UAV mixes and recommend a mix that best supports the future force. Tool also needs a robust ability to spiral in additional capabilities and capture required metrics.
- **Sponsor:** TRAC
- **Partners:** NPS, TRAC-FLVN/WSMR and MRO.

Potential Supporting Research Topics:

1. Work with programmers to improve ASC-U for analysis. Conduct applications analysis.
2. Conduct manned/unmanned trade-off analysis.
3. Conduct cooperative unmanned System analysis.

High Performance Computing Clusters

Project Description and Design of Experiments

and develop the supporting services to allow many current and future constructive simulations to execute a statistical experimental design on a high performance computing cluster (HPCC).

This project will develop a design of experiments (DOE) tool, a data model and a data base implementation on an HPCC to support provisioning, execution and data services for multiple simulations.

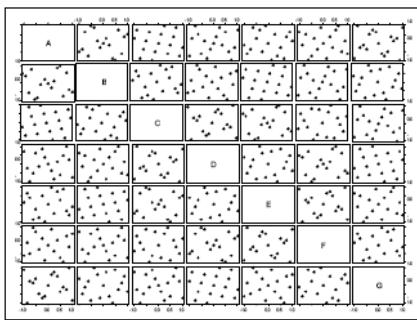


Figure 1. Two-dimensional projections of the best space-filling $(O)^{17}$ design.

Design and analysis are complementary activities. The design must support the desired analysis, and the analysis should derive as much information as possible from the allotted runs. The two should not be considered mutually exclusive constructs, but must be considered from the onset in tandem. (Cioppa, 2001).

Experiment Approaches

Leverage various projects to obtain HPC implementations of various models. Design & implement database. Evolve HPC services. Design & implement DOE GUI.

Sponsor: TRAC.

Partners: NPS Seed Lab, MRO, TRAC-WSMR, MCCDC.

Research Topics:

Defining the Requirements for a Design of Experiments User Interface.

Designing the Database that Supports the HPCC & DOE Environment.

Architecting and Implementing Constructive Simulations for the HPCC & DOE Environment.

Case Study Using IWARS (or COMBAT21 or DAFS) in the HPCC & DOE Environment.

Interior Building Performance of Small Unmanned Ground Vehicles

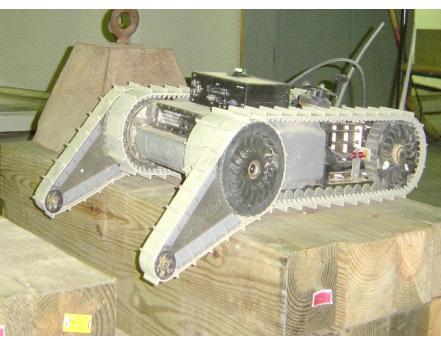
Project Description: Modeling and simulating the performance of Small Unmanned Ground Vehicles (SUGV) is a deficiency. FCS projects 40% of the military fleet may eventually be robotic. Recognizing that doctrine and TTPs continue to evolve, there exists a need to represent the performance of SUGV in Army M&S. Models of the mobility performance of small ground vehicles must be enhanced, modified or existing models validated, before small unmanned vehicle performance can be simulated with confidence.

Technical Approach: This project will improve SUGV performance models based on typical indoor terrain surfaces and appropriate sized obstacles (stairs, curbs).

1. Review current body of knowledge.
2. Perform experiments with SUGV's on interior surface materials.
3. Enhance the STNDMob API to insure valid performance of SUGV's on interior surfaces.

Sponsor: TBD

Partners: ERDC, AMSAA



General Research Topics:

Develop simulation models and conduct analysis of SUGVs in buildings.

UGV Analysis Methodology & Metrics

Project Description: Many unmanned ground vehicles (UGVs) have been produced to meet specific Department of Defense needs without a unifying approach to determine their combat effectiveness and without a thorough methodology to compare different UGVs. Methodologies and Metrics are needed to ensure effective Analysis of Alternatives (AoAs).

Technical Approach: Within the systems engineering and JCIDS processes, determine, through stakeholder analysis, the most effective AoA metrics and methodologies.

Sponsor: Idaho National Laboratory (INL)
Partners: NPS, TRAC-MRO, TRAC-FLVN, TRAC-WSMR



Potential Deliverables (Timeline TBD):

- Use data from live UGV experiments to develop simulation models to conduct analysis of the value of various UGVs.
- Metrics to compare UGVs for given mission sets.
- Analysis and testing methodologies to compare UGVs.
- Determination of how UGVs should behave differently than manned platforms within simulations.
- Models, tools, and simulation representations to improve comparisons of UGVs.

Joint Improvised Explosive Device Defeat Organization (JIEDDO) Analysis Support

Project Description: TRAC will support JIEDDO by investigating and developing a mathematical representation that better informs the relationships among the operational environment, threat activities/behaviors, and Coalition force activities/behaviors correlated with the employment of IEDs against Coalition forces, Host Nation forces, and Host Nation civilians in Iraq and Afghanistan.



JIEDDO Analysis Support seeks to identify the observable data correlated with IED incidents in theatre.

Technical Approach: Data mining and statistical analysis on existing IED-related databases maintained by JIEDDO. Identify data gaps for JIEDDO to fill via Requests for Information from deployed units.

Sponsor: JIEDDO

Partners: TRAC-WSMR, NPS

General Research Topics:

- Identifying, cleaning and pre-processing relevant data.
- Data Mining to identify possible significant correlations among the Operational Environment characteristics, BLUE actions, and Threat actions that produce an IED event.
- Statistical Analysis of relationships identified through the data mining effort.
- Bayesian Belief Net Analysis to further define the relationships and improve the Measures of Effectiveness for the counter-IED fight.

Soldier Representation in Models and Simulation

Project Description: Develop and cultivate NPS faculty and student interest in improving Soldier M&S representation; initiate and maintain a dialogue between USAIC, model developers, and M&S researchers. Improve lines of communication between consumers and developers of Soldier models, simulation, and data.

Technical Approach: Seek and pursue potential NPS faculty and students; provide guidance on critical Soldier M&S gaps; act as a link between NPS personnel, USAIC, and model developers; develop a means to communicate current Soldier M&S needs and developments among all stakeholders.

Sponsor: TRAC

Partners: NPS, Soldier FACT, USAIC, TRAC-WSMR, TRAC-MRO



Screenshot from the Infantry Warrior Simulation (IWARS); such simulations require additional research to improve Soldier representation.

General Research Topics:

- Web portal development.
- Soldier M&S algorithm development.
- Soldier TTP functional/event modeling and analysis.

Dynamic Sustainment for Battle Command Analysis

Project Description: Dynamic Sustainment is a maintenance model that can run either as a stand-alone module or can be linked to an entity-level combat simulation. It will inform the analysis process for studies of future systems. This model is successful when it is implemented with a simulation such as COMBAT^{xxi}.

Technical Approach: Develop a discrete-event maintenance simulation using Simkit as the simulation engine. Implement model so it is capable of dynamically modeling sustainment in a simulation such as COMBAT^{xxi}.

Sponsor: Army G3

Partners: TRAC, AMSAA, & CASCOM



Dynamic Sustainment will address maintenance and CL IX issues

General Research Topics:

- Modeling the maintenance requirements for combat systems.
- Simulating maintenance in various combat scenarios.
- An exploratory analysis using Dynamic Sustainment.
- An analysis comparing current maintenance processes to potential future maintenance processes.
- An analysis considering conditioned-based maintenance concepts.

Logistics Battle Command Model

Project Description: The LBC model will be developed with and for TRAC- LEE and it will build upon capabilities developed for Dynamic Sustainment. The LBC model will dynamically forecast and represent demand for supplies in a simulation such as COMBAT^{XXI}. Priority of effort is Class III, V, and I. The LBC model also represents the distribution network including nodes (storage, maintenance, supply, medical and field services) and arcs (modes of transport).



LBC will work with a simulation such as COMBAT^{XXI}

Technical Approach: Build on Dynamic Sustainment modeling effort. Develop a model that collects OPTEMPO and demand data from a combat simulation such as COMBAT^{XXI} and inject sustainment results back into the simulation to provide more detailed logistical analysis of major operations.

Sponsor: Army G3

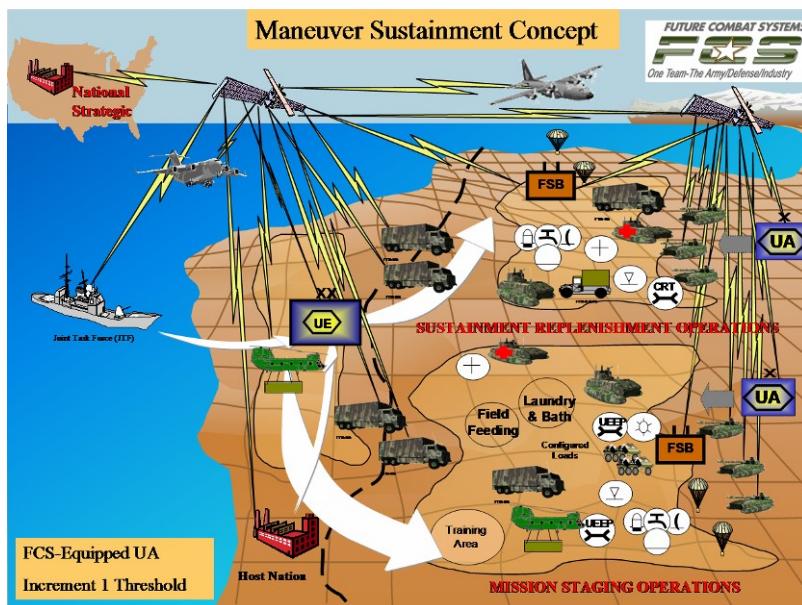
Partners: TRAC, AMSAA, & CASCOM

General Research Topics:

- Forecasting and representing demand for parts and supplies within a combat simulation.
- Logistic Battle Command modeling and analysis.
- Modeling current and future logistical operations and battle command.
- An exploratory analysis using the Logistics Battle Command Model.
- A logistical analysis considering future situational awareness and/or forecasting capabilities.

LBC for Echelons Above Brigade (LBC4EAB)

Project Description: This project will expand TRAC's LBC model to support analysis of forecasting and distribution at echelons above brigade (EAB). The stand-alone tool will emulate FCS Logistics Decision Support System (LDSS) capability for forecasting consumption of supplies. The tool will represent the user-defined distribution network and will explicitly represent scheduled bulk distribution from theatre to brigade using forecasted demands. It will also schedule and arrange for efficient distribution of non-recurring demand items.



LBC4EAB will support the TRAC vision for analysis of future force Sustainment Battle Command 2020

Technical Approach: Capitalize on capabilities developed with TRAC-LEE and WSMR during the LBC modeling effort. Extend the LBC research to develop a stand-alone tool for emulating FCS LDSS capability and represent the efficient distribution of scheduled and non-recurring bulk supplies from theater to brigade.

Sponsor: LOG FACT, HQDA G3/5/7

Partners: TRAC-LEE, TRAC-WSMR, & TRAC-FLVN

General Research Topics:

- Exploratory analysis using the LBC model to determine impact of various alternative logistics plans at EAB.
- Background research on LBC at EAB to develop modeling concepts for the prototype model.
- Exploratory analysis using LBC4EAB.

Land Warrior (LW) / Mounted Warrior (MW)

Project Description The purpose of the LW/MW Doctrine, Organization, Training, Materiel, Leader Development, Personnel, and Facilities (DOTMLPF) Assessment was 1) to determine the DOTMLPF impacts of fielding integrated, networked Soldier fighting systems; 2) to inform a decision on the best Basis of Issue (BOI) for potential LW fielding. Although the study has been completed, we are still in need of data analysis techniques to draw conclusions from questionnaire and interview data.

Technical Approach: Developed, piloted, and administered questionnaires and interviews. Conducted qualitative analysis of unit member military opinion collected through interviews and observation. Conducted quantitative analysis of questionnaire results. Still must develop techniques to analyze these types of data.

Sponsor: PEO Soldier

Partners: TRAC-WSMR, NPS, TSM-Soldier, ARI, AMSAA, ATEC, ARL-HRED, USAAMRMC, TRAC-MRO

LW - Leader Questionnaire, Page 1		LW - Leader Questionnaire, Page 2		LW - Leader Questionnaire, Page 6																																																																																																	
<p>SECTION 1: CAPABILITY GAPS: The Army has identified a hypothesis. Did you observe that Soldier's response to this hypothesis? Did you observe the Lead Warrior pattern's effectiveness at addressing those in the current situation?</p>		<p>1. 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In our opinion, which of the following leader/duty position should have each of the following Lead and Winter functions?</p> <p>MARK ALL POSITIONS THAT APPLY FOR EACH FUNCTION:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">Commander</td> </tr> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">Forward Observer</td> </tr> <tr> <td style="text-align: center;">B</td> <td style="text-align: center;">Medic</td> </tr> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">Anti Tank Gunner</td> </tr> <tr> <td style="text-align: center;">D</td> <td style="text-align: center;">Machine Gunner (MAG)</td> </tr> <tr> <td style="text-align: center;">E</td> <td style="text-align: center;">Rifleman</td> </tr> </table> <p>4. 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<p><i>To provide comments on any question, please refer to the comment sheet at the end of this questionnaire.</i></p>																																																																																																					

Screenshots from the Land Warrior Leader questionnaire.

General Research Topic:

- Analyze and mine collected data to develop unique data statistical analysis techniques for use in these types of data collection efforts.

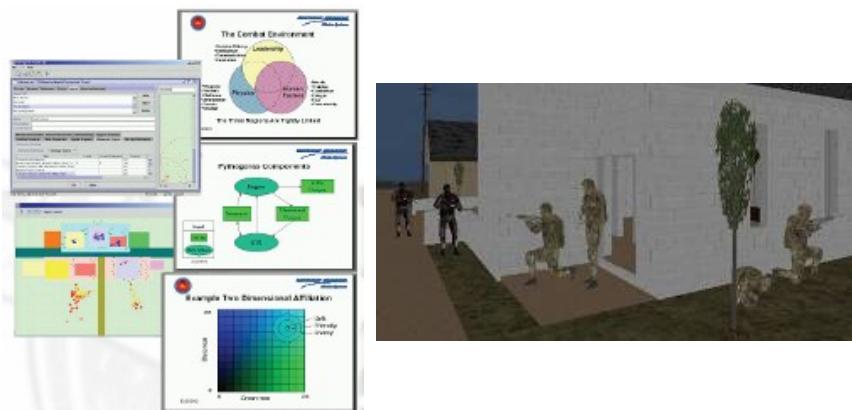
Future Force Warrior (FFW) Experimentation & Analysis

Project Description: Support for FFW live testing to include design of experiments, data collection plans, and post experiment data analysis. Concurrent model test model analysis in constructive simulations to further explore the space. Development of algorithms to represent FFW capabilities in current simulations (OOS, CBT XXI, IWARS).

Technical Approach: Efficient experimental designs will be used to evaluate FFW capabilities on MOEs of interest under a variety of conditions. Data collection plans will focus on quantitative and qualitative measures through empirical data collection and user surveys. Test data will feed algorithm development and a model-test-model effort in constructive simulations.

Sponsor: TPO FFW

Partners: NPS



Pythagoras (an agent based simulation) and IWARS screenshots showing models being used for analysis.

• Potential Supporting Research Topics:

1. Use data and surveys from live experiments to model and analyze the FFW small combat unit.
2. Conduct survey and HSI analysis of FFW sub-systems.
3. Use simulation models and SME input to develop recommendations for potential FFW TTPs.

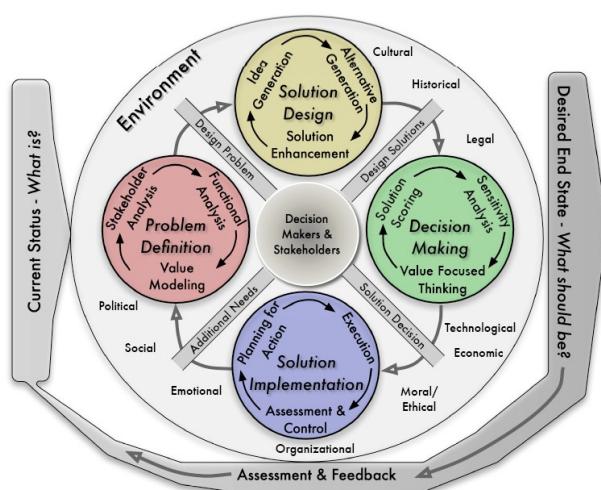
Army Reserve Capabilities Based Prioritization

Project Description: The United States Army Reserve needs a reproducible, quantifiable, qualifiable and auditable methodology to optimize the prioritization of allocation of finite resources. Methodology must balance risk and investment under a range of Army Reserve Expeditionary Force/Army Force Generation Model scenarios in the 2010 time-frame.

Technical Approach: We will use a systematic approach to define the environment within which finite USAR resources are allocated and to identify the appropriate quantitative and qualitative metrics to be used to balance risk, investment and benefit. We will then develop a methodology to optimize resource allocation.

Sponsor: USAR

Partners: NPS, TRAC-LEE, USMA, TRAC-MRO



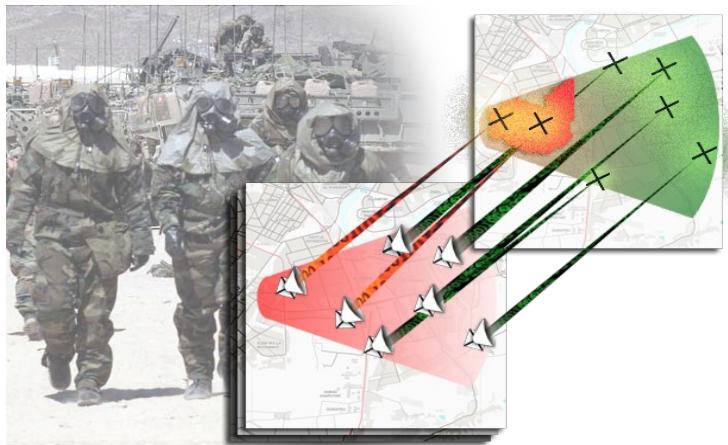
Example Systems Design Process that provides an ideal framework for this type of project.

General Research Topics:

- Develop an optimization model to prioritize USAR resource allocation as part of the developed methodology.
- Identify and develop other potential tools to support the USAR capabilities-based planning process.
- Develop a methodology that incorporates USAR needs, risk, and investment in a way that facilitates prioritization of investment options.
- Develop program metrics to facilitate USAR resource prioritization.

CBRN Tactical Situational Assessment

Project Description: This effort will develop methodologies for improving CBRN situational assessment for mobile forces in Net Centric, decision support models. Findings will facilitate decision making in complex tactical environments to determine whether and how to operate under contaminated conditions.



Technical Approach: Develop mobile force use cases in an agent-based simulation operating in a chemical environment. Determine information requirements in a CBRN environment that impact situational assessment. Identify CBRN-specific MOPs and MOEs that facilitate CBRN decision making. Assess impact of CBRN SA on operations.

Sponsor: DTRA

Partners: AFRL, NPS

General Research Topics:

1. Methodology to assess effects of civilian CBRN exposures on military operations.
2. Methodology to assess physiological and/or psychological effects of extended CBRN operations.

Contact Information

Name	Position	Projects	Phone
LTC Jeffrey Schamburg	Director	All UGV Modeling & Analysis	x3088
Mr. Jack Jackson	Deputy Director	All Logistical & Sustainment Modeling & Analysis Advancements in Computer Science, High Performance Computing, & Experimental Design	x3087
LTC Darryl Ahner	Analyst	IED Data Analysis & Modeling C4ISR Analysis	x7574
MAJ Eric Tollefson	Analyst	Soldier & Small Unit Modeling & Analysis Capabilities-based Prioritization, Decision Science	x7578
MAJ Manuel Ugarte	Analyst	Urban Operations Modeling & Analysis UAV & JDAFS Modeling & Analysis	x7575
MAJ Rich Spainhour	Analyst	IED Data Analysis & Modeling Logistical & Sustainment Modeling & Analysis	x7579
MAJ Mike Martin	Analyst	Information and Ambiguity Modeling Objective OneSAF Improvements	x7580
NOTE: TRAC staff are on the global email system	global_email_system	Soldier & Small Unit Modeling & Analysis	NOTE: TRAC staff are on the global email system